Inappropriate and unnecessary transfusions – lessons from SHOT

Dr Sue Knowles
Interim Medical Director SHOT
July 6th 2011
Royal Society of Medicine
Transfusions given on the basis of erroneous, spurious or incorrectly documented laboratory testing results for haemoglobin, platelets and coagulation results

Transfusions given as a result of poor understanding and knowledge of transfusion medicine, such that the decision to transfuse puts the patient at significant risk, or is actually harmful
SHOT reports of inappropriate and unnecessary transfusions

Figure 6
Cases of inappropriate and unnecessary transfusion 1996–2010
Erroneous sample results

- Unsuitable sample
  - Laboratory warnings overlooked
- Wrong blood in tube
- Point-of-care testing
- Laboratory errors
- Transcription errors
  - Results attributed to incorrect test
  - Results attributed to incorrect patient
Transfusions given on the basis of unsuitable samples or incorrectly documented results 2000-2010 (n = 309)

- Unsuitable sample, 138 (44.7%)
- Wrong blood in tube, 11 (3.6%)
- POCT result, 40 (12.9%)
- Laboratory error, 44 (14.2%)
- Ward transcription, 62 (20.1%)
- Laboratory warning not heeded, 14 (4.5%)
A patient was admitted with dizziness and collapse and a history of CVA. Hb on admission was 11.4 g/dl but dropped to 6.9 g/dl the next day. The patient was transfused with 2 units of red cells. An abdominal USS was requested and haemolysis screen. A referral to a haematology consultant was made. The consultant saw the patient and queried the Hb result. A repeat FBC showed a Hb of 13.1 g/dl. The second sample had been taken from a drip arm.
Unnecessary transfusion based on obviously erroneous result

A patient was admitted to A and E and samples were sent for FBC and crossmatch. A Hb result of 2.7 g/dL was telephoned and the BMS advised to repeat the FBC as the result was suspect. However this was not done and the patient was transfused 2 units of red cells. On admission to the ward a further FBC was taken, showing a Hb of 13.7 g/dL. However 4 further units had already been prescribed and given, prior to this Hb result being reviewed. The post-transfusion Hb was 18.8 g/dL.
Clinical area not heeding laboratory warnings

- Warning not written down
- Written down but ignored or significance not understood
- Not displayed on ward terminal
Unnecessary transfusion could be avoided if laboratories did not transmit results that they know or suspect to be inaccurate, but instead requested a second sample
Clinical transcription errors

A 70-year-old woman presented to A&E looking very pale. A full blood count was telephoned:

Hb 12.6 g/dL, WCC 7.9 x 10^9 /L.

The two figures were mistranscribed and a 2 unit transfusion was prescribed. The error was identified when the post-transfusion Hb was 16.3 g/dL.

When informed of the error, the patient was not upset as she felt much better.
Clinical transcription errors

A 64-year-old male patient on ITU received 3 units of red cells during an emergency laparotomy. Biochemistry results were phoned to the ITU and an albumin of 6 g/dL reported, but a nurse documented this result as a Hb of 6 g/dL. Four units of red cells were then transfused on the basis of this result, resulting in a post-transfusion Hb of 17.6 g/dL.
Unnecessary transfusion could be avoided if laboratories ensured that their procedures for giving a verbal report complied with CPA standards
CPA Standards for the telephoned report

G3 The telephoned report

Laboratories are frequently required to telephone reports to users. The method by which this is done needs to be clearly defined to minimise the risk of error.

G 3.1 Laboratory management shall establish a procedure(s) for giving reports by telephone which includes:

a) the circumstances in which reports may be given
b) the nominated individuals who may give reports
c) the individuals who may receive reports
d) a method of mutual identification of the patient between reporter and receiver
e) a confirmation of correct transmission
f) the mechanism for recording the event
g) the maintenance of confidentiality
h) the process for sending a follow up report.
Dangers of BGA results

A 74-year-old male patient in recovery post hip replacement was drowsy, hypotensive and tachycardic. An Hb estimation from a blood gas analyser was 3 g/dL. A FBC sample was sent to the laboratory, but in the interim 1 unit of “flying squad” blood was commenced. The Hb result from the laboratory was 11.2 g/dL and recovery staff informed of this result advised medical staff to discontinue the transfusion.
Lack of knowledge of POCT testing device

A consultant anaesthetising a paediatric patient estimated that the patient had a blood loss of approximately 700mL during the surgery and asked the ODP for a POCT Hb estimation. The ODP returned from recovery to state that they did not have the model requested but a different model was available. The ODP assumed that this was an alternative device for checking Hb estimation. In fact it was a device for checking blood sugar.

The result of 7.2 was consistent with clinical suspicion and the anaesthetist requested blood on this basis. After 100 mL of blood had been transfused the ODP informed him that he had checked with recovery staff and the machine was for blood sugar testing. The transfusion was stopped and a sample sent to the laboratory. The result was 11.6 g/dL.
CPA Standards for POCT Facilities

A ORGANISATION AND QUALITY MANAGEMENT SYSTEM

CPA Standards for the Medical Laboratory section A and the following apply:

A1 Organisation and management

A 1.6 (POCT) Laboratory management shall ensure that POCT is organized and operates in conformity with these Additional Standards and the CPA (UK) Ltd ‘Standards for the Medical Laboratory’

A 1.7 (POCT) Top management of the organisation within which POCT is provided, shall ensure that there are procedures in place to monitor the quality of the service.

A 1.8 (POCT) The organisation within which POCT is provided, shall ensure that there is a healthcare professional grouping (e.g. a governance group) responsible to its top management for defining the scope of POCT. The scope of POCT shall take into account:

a) the clinical need
b) its financial implications
c) technical feasibility and
d) the resources available.
Patient A with disseminated carcinoma was admitted and a sample taken by a member of the nursing staff and labelled with patient B’s details. (Both patients were group O RhD pos). The patient’s true Hb was 10.6 g/dL but the incorrect result was 6.0 g/dL and on this basis a 3 unit transfusion was prescribed. The patient suffered acute pulmonary complications during the first unit with a drop in pO₂ and the transfusion was stopped. A CXR post transfusion showed pulmonary oedema and the patient deteriorated rapidly and died
Clinical errors related to poor knowledge and understanding

- Inadequate knowledge of transfusion medicine
- Inadequate experience of assessing unstable patients e.g. those with gastrointestinal haemorrhage
- Inadequate knowledge of the patient
Clinical errors related to poor understanding and knowledge

- Incorrect prescription for correct patient
- Prescription for incorrect patient
- Inadequate clinical handover
- No indication for transfusion
- Use of outdated results
- Inadequate monitoring of Hb increments in an unstable patient
- Low body weight patient
Transfusions given on the basis of poor understanding and knowledge 2000-2010 (n = 137)

- No Indication: 35 (25.5%)
- Excess red cells: 27 (19.7%)
- Outdated results: 10 (7.3%)
- Inadequate handover: 12 (8.8%)
- Unnecessary use of O neg: 8 (5.9%)
- Incorrect prescription: 38 (28.5%)
- Low body weight patient: 6 (4.4%)
## Incorrect prescriptions

<table>
<thead>
<tr>
<th>Error</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect dose for paediatric patients</td>
<td>16</td>
</tr>
<tr>
<td>Incorrect dose for adult patients</td>
<td>8</td>
</tr>
<tr>
<td>Incorrect component</td>
<td>12</td>
</tr>
<tr>
<td>Incorrect patient</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td><strong>39</strong></td>
</tr>
</tbody>
</table>
Lack of care and accuracy in paediatric prescribing results in over-transfusion

A very sick preterm infant, aged 12 months, with multiple congenital abnormalities, had been in hospital since birth and was scheduled for elective surgery. The platelet count was $48 \times 10^9$/L. The drug chart stated “1 pool of platelets” and did not specify the volume to be transfused. The nursing staff telephoned a junior doctor who gave the verbal instruction of “15mL per kg”. The nurse misheard the prescription as “50mL per kg” and administered 300mL of platelets over 30 minutes. The infant suffered a cardio-respiratory arrest and was transferred to PICU where she died 2 days later.
A patient with ovarian cancer receiving chemotherapy required an ascitic drain inserted. Her platelet count was $27 \times 10^9$/L and PT and APTT ratios <1.5. A locum FY1 doctor prescribed FFP instead of platelets
Prescription for incorrect patient

An FY1 doctor noted on her handover sheet that patient A with a Hb of 8.4 g/dL was due to be prescribed 2 units of red cells. However she misread this instruction and instead prescribed red cells for patient B with a Hb of 11.6 g/dL.
Unnecessary components given in incorrect doses

A patient was bleeding after a sub-total colectomy and a request was made for 2 doses of platelets and 2 units of FFP. The patient had a normal platelet count (245 x 10⁹/L) and a normal INR of 1.2. The doctor did not check these results. The BMS did not telephone these results to the doctor or contact the consultant haematologist in order to challenge the inappropriate decision.
LESSON

Recommendation from 2007:

“Education of doctors and nurses involved in transfusion must continue beyond basic competency to a level where the rationale behind protocols and practices is understood. Transfusion medicine needs to be a core part of the curriculum”
A patient was bleeding after a sub-total colectomy and a request was made for 2 doses of platelets and 2 units of FFP. The patient had a normal platelet count \( (245 \times 10^9/L) \) and a normal INR of 1.2. The doctor did not check these results. The BMS did not telephone these results to the doctor or contact the consultant haematologist in order to challenge the inappropriate decision.
LESSON

In accordance with Better Blood Transfusion 2007/001, protocols should be in existence which empower laboratory staff to question the appropriateness of requests for transfusion.
Lack of communication between shifts results in baby being transfused twice

A 2-month-old premature baby had an Hb of 9.9 g/dL on the 8th requiring a top-up transfusion and the team on duty that day in SCBU prescribed and gave 60mL red cells. On the 11th another team in SCBU noted the low Hb from the 8th, made a decision to transfuse and prescribed and gave 70 mL red cells. No tick had been placed on the treatment chart, the prescription sheet had not been filed in the correct place and the notes were not checked for recent transfusions. Thus the patient was accidentally transfused twice.
A patient with known hereditary spherocytosis was admitted with an Hb of 7.2 g/dL. The consultant haematologist decided in consultation with the patient that a transfusion was not necessary and the decision was documented in the case notes. However, the low Hb was noted by a nurse on night shift who informed the on-call doctor, who then prescribed 4 units of red cells. Two were given overnight before the decision to stop transfusing was taken the following day.
Recommendation 2010:

“To avoid inappropriate and unnecessary transfusions due to lack of adequate clinical handover, decisions made concerning the need for transfusion support should be documented in the clinical handover templates”
Patient given a transfusion despite responding to oral iron

Following iron deficiency in pregnancy, a female delivered with an Hb of 7.8 g/dL. A decision was taken in conjunction with the patient not to transfuse her, but to discharge her on oral iron. Nine days later, her Hb was checked by the midwife and found to have risen to 8.9 g/dL. Two weeks later, without a further check on her Hb, she was admitted to a community hospital for a blood transfusion at the GP’s request.
GP demands that iron-deficient woman is transfused

A young woman with iron deficiency anaemia, Hb 5.5 g/dL, due to longstanding menorrhagia was sent to A&E by her GP. She was reluctant to have a blood transfusion and went home with a supply of iron tablets. The GP was not satisfied and sent her back. The transfusion practitioner discussed the patient’s concerns and requested the GP to consider alternatives. The patient was sent back again, this time with a letter instructing that transfusion was needed. The request was not discussed at any point with a haematology consultant, and the patient was eventually, reluctantly, transfused.
Patients referred by their GPs to A&E or MAUs for blood transfusion must be referred to a haematologist.
Over-transfusion due to lack of monitoring of response to transfusion in an unstable patient

An elderly patient was admitted to the MAU with a haematemesis and an initial Hb of 10.6g/dL. No details are provided of her observations or the findings on endoscopy but she had further episodes of vomiting blood. Five units of red cells were transfused before a repeat Hb was performed which was 20.4 g/dL. The patient was recognised to have circulatory overload and died shortly afterwards.
In the absence of massive haemorrhage, the patient’s Hb should be checked after every 2 or 3 units of red cells transfused.
Over-transfusion due to lack of monitoring of response to transfusion in an unstable patient

An elderly patient with a severe GI bleed had repeat Hbs of 6.1 and 6.4 g/dL. Six units of red cells were transfused prior to rechecking the Hb, which was 17.1 g/dL. The patient developed circulatory overload and required venesecting 2 units.

An excessive increment in Hb?
An elderly patient of low body weight (29 kg) was admitted with an initial Hb of 7 g/dL. Three units of red cells were prescribed and the post-transfusion Hb was 17 g/dL, confirmed with repeat sampling the following day. She sustained a cerebral infarct 48 hours following the transfusion, which resulted in long-term morbidity.

An excessive increment in Hb?
1 unit of red cells = 1 g/dL increment in Hb in a stable euvolaemic patient?

- Commonly applied rule with poor evidence base
- Inherent variables:
  - Hb content of unit
    - Range in Scotland – 36.69 to 69.34 total Hb/unit
      (Reikvam L et al. Transfusion Medicine 2010; 21: 145)
  - Weight and blood volume of the recipient
Gorlin JB et al
Transfusion 2000;40:263-5

• 1 unit of red cells with a Hct of 38% gives a 2% increase in Hct in a 100 kg man

• 1 unit of red cells with a Hct of 50% gives a 9% increase in Hct in a 50 kg woman
Arslan et al
Transfusion 2004;44:485-488

• Hb content of units measured
• Clinicians asked to provide patient weight and target Hb on the request
• 101 units red cells requested for 51 patients
• Requests translated into total Hb required for transfusion:
  – Total Hb transfused (g) = (Targeted Hb – Actual Hb) g/dL x TBV
• Only 72 units required – 30% reduction
Strong and highly significant correlation between haemoglobin content of RCC with both weight and volume (r = 0.943, 0.937)

Each centre could establish a “standard curve” for this relationship

Weight and/or volume provide a reasonable estimate of the haemoglobin content of the unit
Over-transfusion leading to polycythaemia and a cerebral infarct

An elderly patient of low body weight (29 kg) was admitted with an initial Hb of 7 g/dL. Three units of red cells were prescribed and the post-transfusion Hb was 17 g/dL, confirmed with repeat sampling the following day. She sustained a cerebral infarct 48 hours following the transfusion, which resulted in long-term morbidity.

An excessive increment in Hb?
Application of the empirical paediatric formula

Volume red cells =
(desired Hb g/dL – actual Hb g/dL x weight in kg x 3)

Volume red cells = 10 – 7 x 29 x 3 = 261ml

BCSH transfusion guideline for neonates and older children. BJH 2001;124:433-453
# Morbidity from over-transfusion 2000-2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>Error</th>
<th>Outcome</th>
<th>Underlying diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>2</td>
<td>XS red cells – low BW</td>
<td>Polycythaemia</td>
<td>Haematuria</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsuitable sample</td>
<td></td>
<td>Acute abdomen</td>
</tr>
<tr>
<td>2005</td>
<td>2</td>
<td>XS red cells</td>
<td>TACO</td>
<td>GI bleed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>XS red cells</td>
<td>Polycythaemia</td>
<td>Surgery</td>
</tr>
<tr>
<td>2007</td>
<td>4</td>
<td>Inadequate handover</td>
<td>TACO</td>
<td>CRF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Incorrect prescription</td>
<td>TACO</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>XS red cells</td>
<td>Polycythaemia</td>
<td>Regular transfusion for iron deficiency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>XS FFP</td>
<td>TACO</td>
<td>Warfarin reversal</td>
</tr>
<tr>
<td>2008</td>
<td>1</td>
<td>Incorrect prescription</td>
<td>Polycythaemia</td>
<td>Unknown (infant 1 year)</td>
</tr>
<tr>
<td>2009</td>
<td>1</td>
<td>Incorrect prescription</td>
<td>Polycythaemia</td>
<td>Unknown (infant 1 year)</td>
</tr>
<tr>
<td>2010</td>
<td>4</td>
<td>XS red cells</td>
<td>TACO</td>
<td>GI bleed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WBIT</td>
<td>TACO</td>
<td>Carcinoma</td>
</tr>
<tr>
<td></td>
<td></td>
<td>XS red cells – low BW</td>
<td>Polycythaemia</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>XS red cells</td>
<td>Polycythaemia</td>
<td>Premature infant</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Mortality from over-transfusion 2000-2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>Error</th>
<th>Outcome</th>
<th>Underlying diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000/1</td>
<td>2</td>
<td>Unsuitable sample</td>
<td>Cardiac arrest</td>
<td>IHD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsuitable sample</td>
<td>TACO</td>
<td>GI bleed</td>
</tr>
<tr>
<td>2001/2</td>
<td>2</td>
<td>Unsuitable sample</td>
<td>TACO</td>
<td>GI bleed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsuitable sample</td>
<td>TACO</td>
<td>GI bleed</td>
</tr>
<tr>
<td>2004</td>
<td>1</td>
<td>WBIT</td>
<td>TACO</td>
<td>Unknown</td>
</tr>
<tr>
<td>2005</td>
<td>1</td>
<td>Misdiagnosis haemorrhage</td>
<td>TACO</td>
<td>Acute abdomen</td>
</tr>
<tr>
<td>2006</td>
<td>2</td>
<td>Paediatric prescription</td>
<td>Cardiac arrest</td>
<td>Premature infant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsuitable sample</td>
<td>TACO</td>
<td>Fractured femur</td>
</tr>
<tr>
<td>2008</td>
<td>1</td>
<td>XS red cells</td>
<td>Polycythaemia</td>
<td>GI bleed</td>
</tr>
<tr>
<td>2009</td>
<td>2</td>
<td>WBIT</td>
<td>TACO</td>
<td>Carcinoma</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsuitable simple</td>
<td>TACO</td>
<td>Fractured femur</td>
</tr>
<tr>
<td>2010</td>
<td>1</td>
<td>XS red cells</td>
<td>TACO</td>
<td>GI bleed</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Summary

- 586 I&U reports received since 2000
- 12 deaths to which the transfusion contributed to a varying extent
  - 9/12 due to TACO
- 14 cases of major morbidity
  - 6/14 due to TACO
- Serious outcome for 4.5% cases reported
Thanks

- Steering Group and Working Expert Group
- Dr Hannah Cohen, Steering Group Chair
- Alison Watt, Operations Manager
- Debbi Poles, Research Analyst
- Tony Davies, SHOT transfusion liaison practitioner
- Julie Ball and Hema Mistry, incident specialists
- Kathryn Gradwell and Victoria Peake, information officers
- NHSBT for accommodation in Manchester and London
- UK Forum for funding
- HTTs for reporting cases to SHOT